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U.S. Forest Service. Pacific Northwest Region.

FUEL TYPE MAPPING
NORTH PACIFIC REGION
1937

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FOREST SERVICE

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Fire
Fuel Type Mapping

Portland, Oregon
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SPECIFICATIONS AND INSTRUCTIONS

FOR EXTENSIVE FUEL TYPE MAPPING IN REGION SIX

1. DEFINITION

A fuel type map is a graphic representation of forest fuels in terms of the rate of spread of fire and the resistance to control of fire.

Rate of spread is measured in terms of units of perimeter increase per hour.

Resistance to control is measured in terms of units of held fire line per man hour to time of corral (exclusive of SOS).

2. PURPOSE

The fuel type maps will become one of the principal basic sources of information used in all phases of fire control planning. An inventory of fuels is as basic to fire control planning as an inventory of timber is to forest management. Fuel type maps have many possibilities for use in current fire control administration, such as in calculating probabilities and in taking suppression action. They will also be used in conjunction with the fire occurrence maps in determining guard placement and in planning transportation facilities.

3. GENERAL SPECIFICATIONS OF THE FUEL TYPE MAPS

A. Base Map. Use Forest Survey Type map, 1-inch scale, furnished by the Regional Office on which to record the fuel types in the field and office.

B. Make the fuel type map in the field, using all existing sources of information.

C. Map unit - ranger district.

D. Completed maps - to be made so that they can be reproduced in quantity and colored as desired. (Like R-6 Forest Survey type maps.)

E. Fuel type specifications - to be so set up that they will fit into the scheme proposed for national adoption, i.e. classes of rate of spread and classes of resistance to control to be related one to another on a ratio of 1, 2, 4, 8, 16, etc., units per hour.

F. Assume August conditions. Fuel conditions on all areas should be mapped on the basis of their August or worst condition. Mapping will be done according to the way areas appear in the year they are viewed by the mapper. an exception to this might be a slash area which is to be burned. In this case the mapper should map the area as it will appear after the burn.

G. Most intensive field coverage to be in areas of -

1. Highest occurrence
2. Most dangerous fuels

4. FUEL TYPE SPECIFICATIONS

Each fuel type area is defined by one of four rate-of-spread and one of four resistance-to-control classes, making sixteen possible fuel types in all. The four classes for both rate of spread and resistance to control are:

Extreme
High
Moderate
Low

These are abbreviated to - X, H, M, and L. Thus a type is designated by the symbol XH, LL, LH, etc., and referred to as an "Extreme High" type, etc.

Factors influencing rate of spread. Rate of spread should be estimated on the basis of the probable increase in perimeter of a small fire under average bad August conditions in the particular locality being typed. As the starting point in estimating rate of spread, a typical, slow-spreading fuel type--for example, the densely shaded Douglas fir type condition where the ground is covered principally with moss and duff--should be considered the standard Low condition and the rate of spread in all other fuel types compared to it. In other words, on a numerical basis this standard Douglas fir type would have a value of 1 and an M rate of spread would have a value of 2, i.e. the rate of spread would be approximately twice as fast; an H rate of spread would be approximately four times as fast and an X rate of spread would be eight or more times as fast.

The principal items to be watched in estimating rate of spread are:

1. Volume of fine fuels
2. Fineness of fuels
3. Arrangement of fine fuels
4. Slope of the ground under the fuels
5. Degree of exposure of the fuels to the sun
6. Normal wind velocity and degree of exposure of the fuels to wind
7. Special items, such as snags, tree moss, bug-killed trees, and so forth, that would affect the spread of the fire.

Factors influencing resistance to control. Since resistance to control is an estimate of the units of man power required to control a unit of fire perimeter, in estimating this factor attention should be focused on all items that will consume the time of fire fighters. A standard Low resistance-to-control type condition should be established and kept constantly in mind in estimating resistance to control in the same way that the standard Low type condition is used in estimating rate of spread.

The following are the principal items to be watched in estimating resistance to control:

1. Ground cover conditions--low brush, weeds, vines etc., that will slow up the rate of line construction.
2. Number and size of snags to be cut.
3. Number and size of windfalls that must be cut.
4. Amount of rotten wood and depth of duff and litter to mineral soil.
5. Brush and reproduction to be cut in line construction.
6. Soil conditions and roots as they affect rate of line construction.
7. Slope as it affects man power production.

In estimating resistance to control, hand work will be assumed, although type areas suitable for machine line construction should be shown by an extra symbol on the map.

For emphasis it may be well to repeat that resistance to control applies to handling a small fire and the estimate of work required should be on that basis and should not be concerned at all with methods which apply only to large fires. The duration of the work is the time required to corral a fire.

Photographs of fuel types. Photographs of typical examples of the fuel types are a part of these instructions. It is believed that they will greatly facilitate the production of strictly comparable fuel type classifications on all maps. Forests are encouraged to secure a set of photographs showing examples of local types. Ratings of these photographs should be coordinated by the Regional Office.

How fuel type information will be shown on the map. At least one set of complete fuel type symbols must be shown for each fuel type area. As a general rule one set of symbols should be shown for each square inch of map surface according to the following scheme and always in the order specified:

First, symbol representing rate of spread; second, symbol representing resistance to control--for example, LM, MM, etc. (on first line).

Beneath this, abbreviation indicating Forest Survey type--for example, T6, T20, etc.

Next below, abbreviation indicating most important factor contributing to rate of spread.

Beneath this, abbreviation indicating most important factor contributing to resistance to control.

Next below, indicate the average prevailing per cent of slope expressed in four classes as follows:

Extreme - - - - - - - - - - -Over 75%
High - - - - - - - - - - -50% to 75%
Moderate - - - - - - - - - -25% to 50%
Low - - - - - - - - - - - - 0% to 25%

Below this, indicate any special items such as machine shows, etc.

Example:

(Abbreviations: X, H, M and L)

HM (High rate of spread--moderate resistance to control)

T6 (Forest Survey Type 6)

B Fern (Brackon is principal item contributing to rate of spread)

VM (Vine maple is principal item contributing to resistance to control)

H% (50 to 75 per cent slope)

The standard abbreviations on page 7 are to be used on the fuel type maps.

The first two symbols, namely rate of spread and resistance to control, define the type and will, of course, be the same throughout a type area. Any one or all of the remaining symbols may change within the type area; for example, an MM type area might have the following four sets of type designations:

MM	MM	MM	MM
T6	T6	T6	T7
Duff	Ferns	Moss	Ferns
Logs	Brush	Rock	Roots
L%	M%	H%	X%

Coloring maps. As the field work is completed the maps will be colored according to the following scheme:

The rate of spread of each type area will be shown by outlining the area in the rate-of-spread color and the resistance to control will be shown by coloring the area solid with the resistance-to-control color. In this way the same color used for

each rate-of-spread class is used for a corresponding resistance-to-control class. The colors used are as follows:

Extreme - - - - - Red - - - - - Dixon's 321½

High - - - - - Orange - - - Dixon's 324

Moderate - - - - Blue - - - - Dixon's 320

Low - -- - - - - Green - - - - Dixon's 354½

5. INTENSITY AND ACCURACY OF THE WORK

In order to contribute their share to the fire control planning job the fuel type maps must be as intensive and as accurate as the specifications of the major job demand.

The intensity of a map may vary according to either the rate of spread or resistance to control. The following are the minimum type areas to be mapped in each fuel class:

Extreme - - - - 40 acres Moderate - - - - 160 acres

High - - - - - 80 acres Low - - - - - - - - 160 acres

The more severe factor in each fuel class will govern the intensity of the map. For example both HL and LH fuel types will be mapped to 80 acres. These specifications contemplate that one mapper should be able to cover a minimum of 5 to 10 sections per day.

6. FIELD PROCEDURE

The type mapper will take into the field all sources of information, which in most cases will consist principally of the Forest Survey type maps, timber reconnaissance maps, topographic maps, and pictures. In order to cover ground at the rate indicated above it is necessary to look upon the field job as a process of translating on the ground existing information into fuel types.

Travel. It will be necessary to reduce cross country walking to an absolute minimum. Lookout and other high points should be used from which a general view may be secured of the area to be mapped. Fuel type boundaries should be sketched in and a schedule made for travel into the various types to classify the fuels. It will be extremely important to plan routes of travel so that the most country can be covered without traveling the same routes twice. On a few forests it may be possible to do practically the entire job from roads. As experience is gained in each locality in translating Forest Survey types, topographic

maps, and other sources of information into fuel types, the amount of travel can be materially reduced. In certain localities it will probably be found that certain timber types are quite consistent in their relation to fuel types, and once this fact is learned, these timber types can be translated into fuel types with a minimum of field inspection.

7. TRAINING AND SUPERVISION

It is essential that every type mapper receive training before attempting to do this work. Fire fighting experience is desirable but not absolutely essential. All fuel typers, whether experienced fire fighters or not, should check constantly with local forest officers in order to get their opinion of the fuel classifications made. Training will be largely by having individuals or groups work with an experienced type mapper until they are capable of working alone.

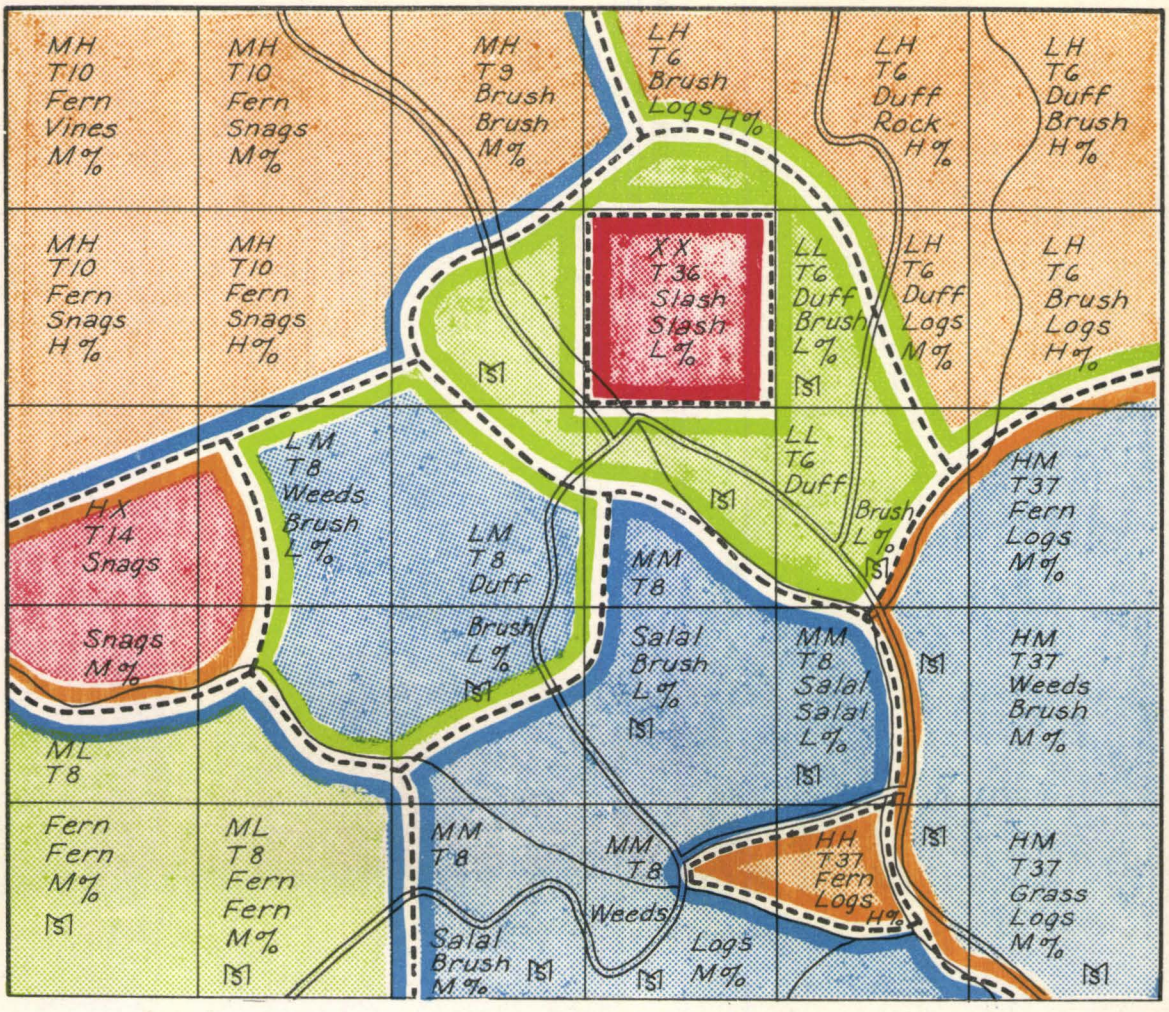
8. COMPLETED MAPS

Each field map should be checked and matched with adjacent maps. When the fuel type data are complete and in readily understood form, these maps will be forwarded to the Regional Office where such further drafting and copying as may be required will be done.

Abbreviations to use for Cover Items Affecting Rate of Spread or Resistance to Control

---

Bark	Bark
Bear Grass	B. Grass
Bitter Brush	Bit. Br.
Blackberry Vine	BB. Vine
Bracken Fern	B. Fern
Brush, Misc.	Brush
Ceanothus	Cnths.
Cones	Cones
Devil Club	Dev.Club
Dead Limbs	Dd. Lmbs.
Dog Wood	Dg. Wood
Elder Berry	El. Ber.
Fire Weed	F. Weed
Fern, Bracken	B. Fern
Fern, Sword	S. Fern
Grass	Grass
Ground Moss	Gr. Moss
Huckleberry	Hu. Ber.
Leaves	Leaves
Litter	Litter
Logs	Logs
Mahogany	Mhgny
Manzanita	Mnzta
Mountain Alder	M. Alder
Needles	Ndls.
Oregon Grape	Ore. Gr.
Rhododendron	Rhod.
Reproduction	Reprod.
Rotten Wood	Rt. Wood
Salal	Salal
Salmon Berry	Sal. Ber.
Sage Brush	Sage Br.
Snow Berry	Sn. Ber.
Sword Fern	S. Fern
Thimbleberry	Th. Ber.
Thistle	Ths.
Tree Moss	Tr. Moss
Vine Maple	Vn. Map.
Weeds	Weeds
Willow	Will.



FUEL TYPE MAP

LEGEND

Boundary of fuel types ----------

Rate of Spread of fire and Resistance to Control are both typed as either Extreme (X), High (H), Moderate (M), or Low (L).

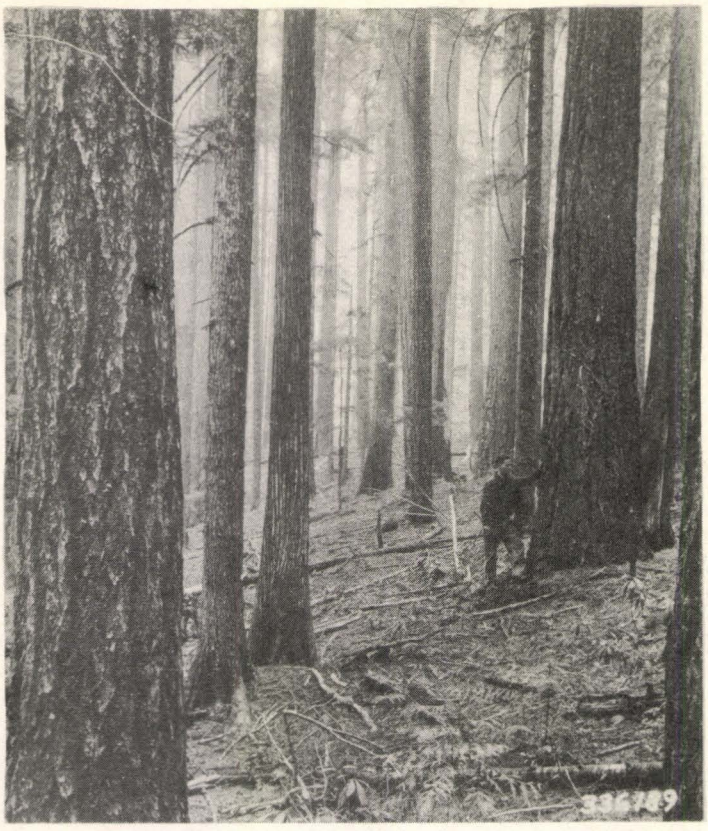
Each fuel type area is outlined in its rate-of-spread color and colored solid with its resistance-to-control color, as follows:

Extreme (X)	Red
High (H)	Orange
Moderate (M)	Blue
Low (L)	Green

Explanation of Fuel Type Symbols:

- HM - High rate of spread and moderate resistance to control.
- T6 - Forest Survey type 6.
- Grass - Grass is principal item contributing to rate of spread.
- Brush - Brush is principal item contributing to resistance to control.
- M% - 25-50 percent slope
- M_S - Machine show (or other special item)

These items are always listed in this order.



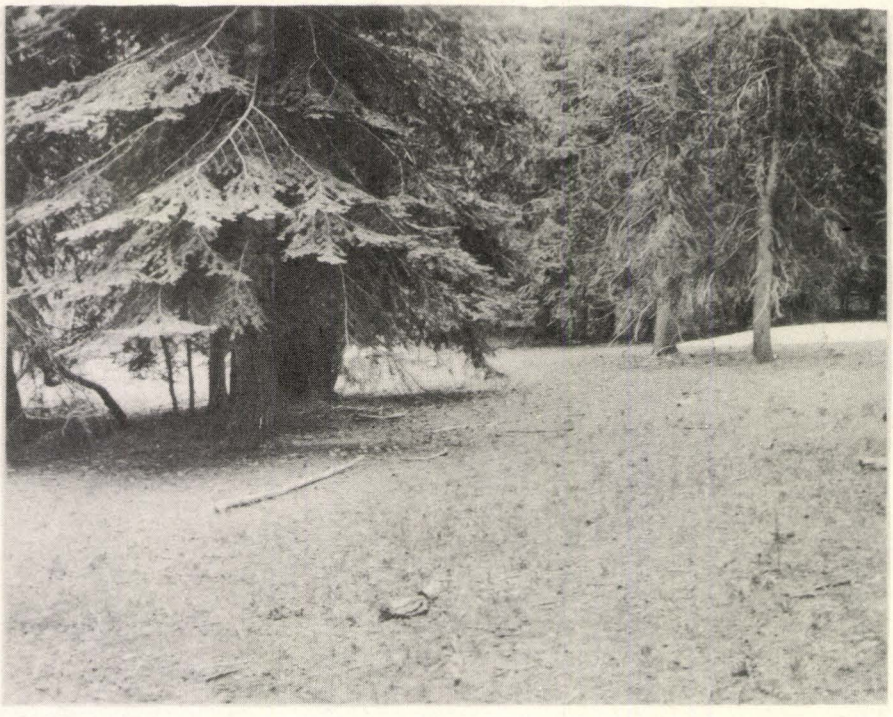
LL
T6
Litter
Duff
L%
M
S

Timber type: Dense stand of Douglas fir, hemlock, and cedar (Forest Survey types 6, 7, 14 or 17).

Ground cover: Litter, duff, and rotten wood. Open, not much brush. Few logs or snags.

Slope: L or M. Steeper slopes might be rated ML.

Exposure: Any.



LL
T23
Duff
Duff
L%
M
S

Timber type: White fir, lodgepole, or subalpine (Forest Survey types 23, 26, or 33).

Ground cover: Thin duff packed by deep snow.

Slope: L or M. Steeper slopes might be rated ML.

Exposure: Any.

LM
T8
Sword Fern
Brush
M%
M
S

Timber type: Dense stand of second-growth Douglas fir and alder (Forest Survey types 8 or 9).

Snags and logs: No snags and very few logs.

Ground cover: Continuous stand of sword fern 2 to 3 feet high. Clumps of vine maple and salmon berry brush. Moderately deep moss and duff.

Slope: L or M.

Exposure: Any exposure with full shade.

LH
T14
Moss
Logs
L%
M
S

Timber type: Decadent western hemlock or Sitka spruce stand. (Forest Survey types 14 or 11).

Snags and logs: Many dead topped trees, many snags and logs.

Ground cover: Deep moss, rotten wood, and duff. Sword fern, salmon berry, and devil's club. Dense shade.

Slope: L or M. Steeper, more exposed slopes might be rated MH.

Exposure: Any.

ML
T20
Needles
Logs
L%
M
S

Timber type: Ponderosa pine (F.S. type 20).

Snags and logs: Snags almost absent, an occasional large log.

Ground cover: Needles and cones and very thin brush.

Slope: L or M.

Exposure: Any.

ML
T8
Litter
Logs
M%
M
S

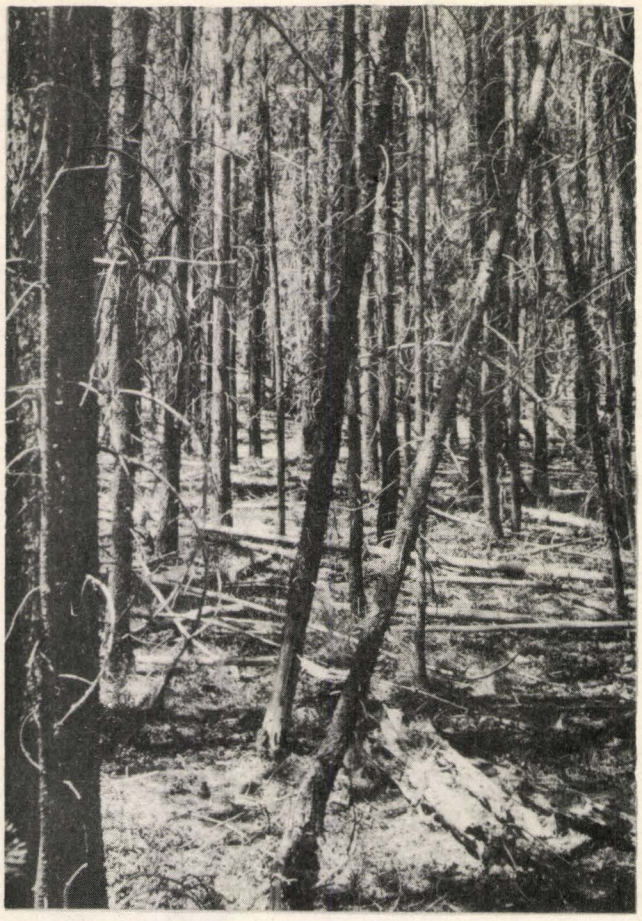
Timber type: Large second-growth Douglas fir (F.S. type 8).

Snags and logs: No snags and very few logs.

Ground cover: Mostly salal and Oregon grape. Deep litter.

Slope: M and H.

Exposure: Any except damp north slopes and except south exposure on H slopes.



MM
T26
Litter
Poles
L%
M
S

Timber type: Lodgepole pine (Forest Survey type 26).

Snags and logs: Many standing and down dead poles.

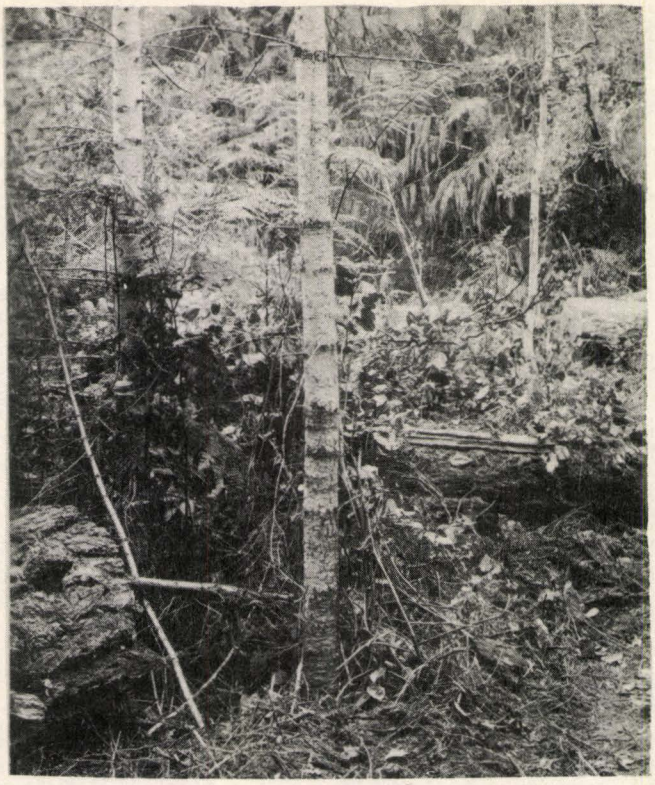
Ground cover: Litter and scattered grass and weeds.

Slope: L or M.

Exposure: Any.

MM
T8
Litter
Logs
H%

Timber type: Second growth Douglas fir (Forest Survey type 8 or 9).
Snags and logs: Few large snags, many small logs and few large logs.
Ground cover: Dead limbs, ferns, weeds, and brush.
Slope: M and H.
Exposure: Any on M slopes. Any but south on H slopes.



MH
T10
Bracken
Logs
L%
M
S

Timber type: Douglas fir poles in burn or cutover (F.S. type 10 or 34-10).

Snags and logs: Large, short snags and many large logs.

Ground cover: Jungle of bracken, salal, and brush.

Slope: L or M.

Exposure: Any except north.

MH
T26A
Logs
Logs
L%
M
S

Timber type: Lodgepole reproduction (Forest Survey type 26-A).

Snags and logs: Very few lodgepole pine snags standing. Many medium or small-sized logs.

Ground cover: Mostly needles and twigs with some grass and weeds.

Slope: L or M.

Exposure: Any.

HL
T20
Grass
Sod
L%
M
S

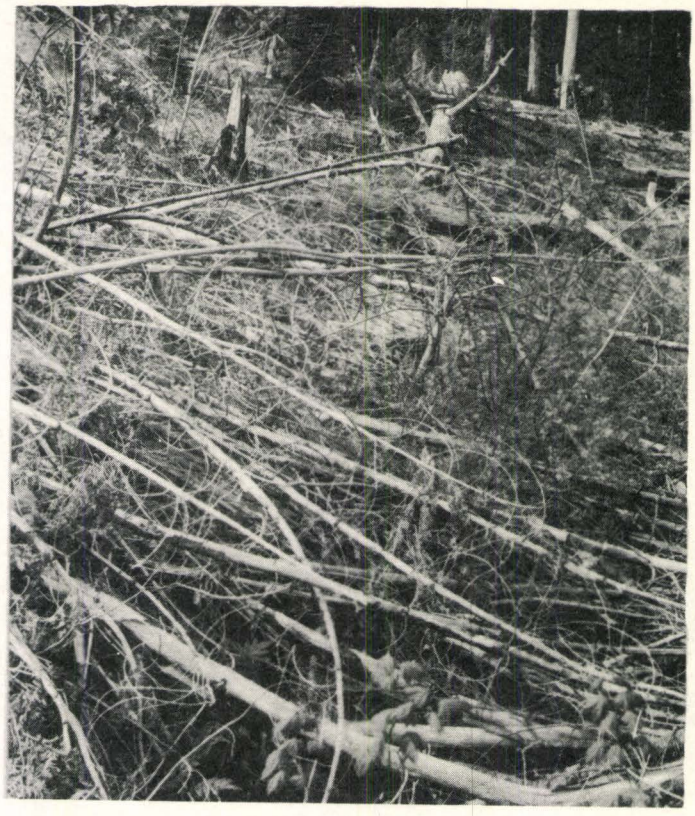
Timber type: Ponderosa pine (Forest Survey types 20, 20.5 or 20A).

Snags and logs: Absent or not important.

Ground cover: Continuous cover of cheat grass and other grass and weeds.

Slope: L or M.

Exposure: Any.



HM
T37
Litter
Logs
M%
M
S

Timber type: Second burn which killed reproduction on old burn (Forest Survey type 37).

Snags and logs: Few snags, many medium sized short rotten logs.

Ground cover: Dead poles, dead brush, bracken, weeds, vines, and clumps of brush.

Slope: L, M, or H.

Exposure: Any except L and M north slopes.

HH
T26
Litter
Poles
H%

Timber type: Lodgepole pine (Forest Survey type 26A.)

Snags and logs: Many. Small.

Ground cover: Grass and weeds.

Slope: M or H.

Exposure: Any.

HH
T34-10
Bracken
Logs
M%
M
S

Timber type: Cutover - Douglas fir and hemlock (F.S. type 34-10).
Snags and logs: Few snags and large dead topped hemlocks. Many small to medium sized logs.
Ground cover: Bracken and grass in openings. Clumps of brush. Some reproduction.
Slope: M or H.
Exposure: Any except north.

HX
T36
Slash
Logs
L%
M
S

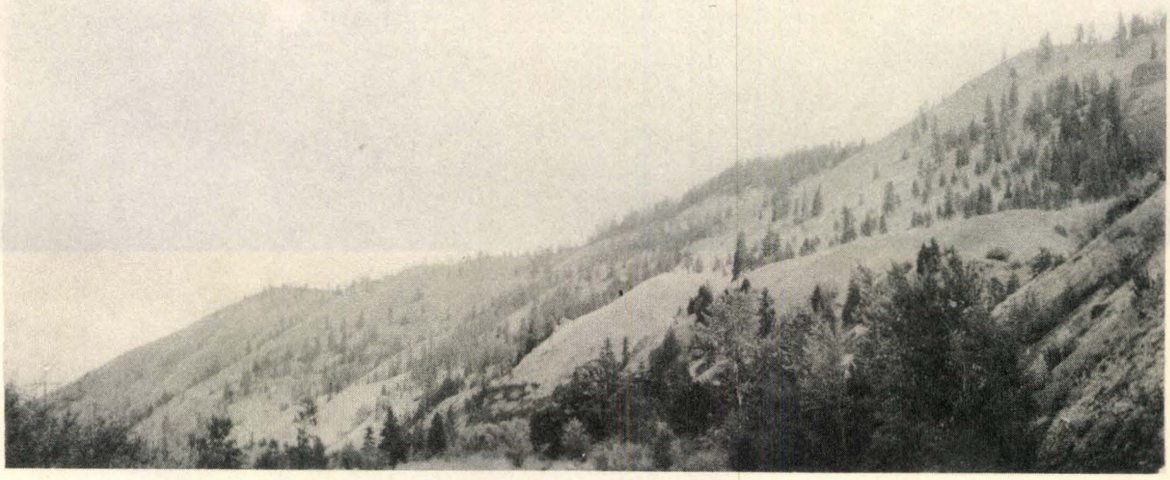
Timber type: Recent cutover in Douglas fir, cedar, hemlock, and white fir stand. (Forest Survey type 36).

Snags and logs: Very few snags but extreme number of logs.

Ground cover: Fresh slash with needles on.

Slope: L or M.

Exposure: Any.



XL
T5½
Grass
Grass
H%

Timber type: Scattered ponderosa pine. (Forest Survey type 5½.)

Snags and logs: Almost absent.

Ground cover: Cheat grass, almost continuous.

Slope: H or X.

Exposure: Any exposed slope.

XH
T37
Dead poles
Poles
M%

Timber type: Fire-killed Douglas fir, white fir, and hemlock poles (Forest Survey type 37, 37-9, or 37-10).

Snags and logs: Extreme number of standing and down dead poles 4"-8" diameter with limbs on and loose bark. Few large snags and logs.

Ground cover: Litter from poles, also fireweed and blackberry vines.

Slope: M or H.

Exposure: Any except north on M slopes.

XX
T10
Snags
Snags
H%

Timber type: Douglas fir single burn 10 to 40 years old. (F.S. Type 37 or 10, etc.)

Snags and logs: Many and large.

Ground cover: Brush, reproduction, bracken, vines, weeds and litter.

Slope: H or X.

Exposure: Any.

XX
T37
Snags
Poles
M%

Timber type: Pole stand of Douglas fir and white fir. (F.S. type 37.)

Snags and logs: Many dead poles, standing and down. Dead limbs. Also large snags and logs.

Ground cover: Dead poles and limbs conspicuous, also fireweed, bracken, and vines.

Slope: M, H or X.

Exposure: Any except North on M slopes.